

## CLAIMS

1. In a pipe coupling comprising a socket and a mating plug insertable into said socket for coupling engagement,

said socket including:

a cylindrical socket body having a first through aperture extending radially therethrough;

a locking element radially movable within said first through aperture, said locking element being movable between a first radial position wherein said locking element is engaged with a locking recess on said plug so as to inhibit disconnection of said plug from said socket and a second radial position wherein said locking element is radially outwardly displaced from said first radial position and disengaged from said locking recess to allow disconnection of said plug from said socket;

a sleeve disposed around said socket body and having a locking surface adapted to hold said locking element against radial outward movement and prevent movement of said locking element from said first radial position to said second radial position and an unlocking surface adapted to allow movement of said locking element from said first radial position to said second radial position, said sleeve being axially movable between a locking position wherein said locking surface is positioned radially outwardly of said locking element and an unlocking position wherein said unlocking surface is positioned radially outwardly of said locking element; and

a spring for biasing said sleeve toward said locking position,

said plug including:

a coupling end directed toward said socket; and

a cylindrical surface extending from said coupling end in a direction away from said socket, said locking recess being defined on said cylindrical surface,

said coupling end of said plug being slidably engaged with said locking element located in said first radial position to cause radial outward movement of said locking element when said plug is inserted into said socket,

said socket characterized in that:

said socket body comprises a second through aperture located axially closer to said plug than said first through aperture and extending radially therethrough and a sleeve actuator disposed in said second through aperture and movable between a radially inward position wherein said sleeve actuator is engaged with said coupling end of said plug upon insertion of said plug into said socket and a radially outward position wherein said sleeve actuator is located radially outwardly from said radially inward position; and

said sleeve has an inclined surface inclined radially outwardly from said locking surface toward said unlocking surface, said inclined surface being engaged with said sleeve actuator when said sleeve is located in said locking position, said coupling end of said plug being engaged with said sleeve actuator upon insertion of said plug into the socket so that said sleeve actuator is radially outwardly moved to thereby cause axial movement of said sleeve against the bias of said spring, wherein when said coupling end of said plug is brought into engagement with said locking element during advancement of said plug, said inclined surface is moved to a radially outward position relative to said locking element, said coupling end of said plug radially outwardly urging said locking element against said inclined surface of said sleeve upon further insertion of said plug, thereby causing further axial movement of said sleeve.

2. A socket according to claim 1, wherein said locking recess has a given axial length and includes axially opposite circumferential side walls, said sleeve actuator and said locking element being engaged with said side walls when said spring urges said sleeve in a direction opposite the direction in which said plug is inserted into said socket after said sleeve actuator and said locking element are moved into said locking recess upon insertion of said plug into said socket.

3. In a pipe coupling comprising a socket and a mating plug insertable into said socket for coupling engagement,

said socket including:

a cylindrical socket body having a first through aperture extending radially therethrough;

a locking element radially movable within said first through aperture, said locking element being movable between a first radial position wherein said locking element is engaged with a locking recess on said plug so as to inhibit disconnection of said plug from said socket and a second radial position wherein said locking element is radially outwardly displaced from said first radial position and disengaged from said locking recess to allow disconnection of said plug from said socket;

a first sleeve disposed around said socket body and having a locking surface adapted to hold said locking element against radial outward movement and prevent movement of said locking element from said first radial position to said second radial position and an unlocking surface adapted to allow movement of said locking element from said first radial position to said second radial position, said first sleeve being axially movable between a locking position wherein said locking surface is positioned radially outwardly of said locking element and an unlocking position wherein said unlocking surface is positioned radially outwardly of said locking element; and

a first spring for biasing said first sleeve toward said locking position, said plug including:

a coupling end directed toward said socket; and

a cylindrical surface extending from said coupling end in a direction away from said socket, said locking recess being defined on said cylindrical surface,

said coupling end of said plug being slidably engaged with said locking element located in said first radial position to cause radial outward movement of said locking element when said plug is inserted into said socket,

said socket characterized in that:

said socket body comprises a second through aperture located axially closer to said plug than said first through aperture and extending radially therethrough and a sleeve actuator disposed in said second through aperture and movable between a radially inward position wherein said sleeve actuator is engaged with said coupling end of said plug upon insertion of said plug into said socket and a radially outward position

wherein said sleeve actuator is located radially outwardly from said radially inward position; and

said first sleeve has an inclined surface inclined radially outwardly from said locking surface toward said unlocking surface, said inclined surface being engaged with said sleeve actuator when said first sleeve is located in said locking position, said coupling end of said plug being engaged with said sleeve actuator upon insertion of said plug into the socket so that said sleeve actuator is radially outwardly moved to thereby cause axial movement of said first sleeve against the bias of said spring, wherein when said coupling end of said plug is brought into engagement with said locking element during advancement of said plug, said inclined surface is moved to a radially outward position relative to said locking element, said coupling end of said plug radially outwardly urging said locking element against said inclined surface of said sleeve upon further insertion of said plug, thereby causing further axial movement of said sleeve,

said socket further comprising:

a second sleeve disposed around said first sleeve and movable between a first axial position and a second axial position, said second sleeve allowing axial movement of said first sleeve upon insertion of said plug when said second sleeve is placed in said first axial position, said second sleeve moving said first sleeve from said locking position to said unlocking position against the bias of said first spring when said second sleeve is moved from said first axial position to said second axial position, said second sleeve being rotatably moved on said socket between a first angular position and a second angular position; and

a stopper arranged on said socket, said stopper being engaged with said second sleeve to prevent axial movement of said second sleeve when said second sleeve is placed in said first angular position,

said second sleeve having a stopper receiving portion configured to prevent engagement of said stopper with said second sleeve and allow axial movement of said second sleeve when said sleeve is placed in said second angular position.

4. A socket according to claim 3, further comprising a second spring for urging said second sleeve toward said first angular position.

5. A socket according to claim 4, further comprising a coil spring disposed around said socket body, said coil spring having one end located at a given angular position on said socket body and engaged with said first sleeve to serve as said first spring to urge said first sleeve toward said locking position, and an other end engaged with said second sleeve and adapted to serve as said second spring to urge said second sleeve toward said first angular position.

6. A socket according to any one of claims 3 to 5, wherein said second sleeve has a first end adjacent to said plug and a second end remote from said plug,  
wherein said stopper receiving portion includes a slot extending from said second end toward said first end of said second sleeve, and

wherein said stopper extends radially outwardly from said socket, said stopper being engaged with said second end of said second sleeve when said second sleeve is located in said first angular position, said stopper being axially aligned with said slot to allow said second sleeve to be moved to said second axial position when said second sleeve is placed in said second angular position.

7. A pipe coupling comprising a socket and a mating plug insertable into said socket for coupling engagement,

said socket including:

a cylindrical socket body having a first through aperture extending radially therethrough;

a locking element radially movable within said first through aperture, said locking element being movable between a first radial position wherein said locking element is engaged with a locking recess on said plug so as to inhibit disconnection of said plug from said socket and a second radial position wherein said locking element is radially outwardly displaced from said first radial position and disengaged from said locking recess to allow disconnection of said plug from said socket;

a sleeve disposed around said socket body and having a locking surface adapted to hold said locking element against radial outward movement and prevent movement of said locking element from said first radial position to said second radial position and an unlocking surface adapted to allow movement of said locking element from said first radial position to said second radial position, said sleeve being axially movable between a locking position wherein said locking surface is positioned radially outwardly of said locking element and an unlocking position wherein said unlocking surface is positioned radially outwardly of said locking element; and

a spring for biasing said sleeve toward said locking position,  
said plug including:

a coupling end directed toward said socket; and

a cylindrical surface extending from said coupling end in a direction away from said socket, said locking recess being defined on said cylindrical surface,

said coupling end of said plug being slidably engaged with said locking element located in said first radial position to cause radial outward movement of said locking element when said plug is inserted into said socket,

said socket body comprising:

a second through aperture located axially closer to said plug than said first through aperture and extending radially therethrough and a sleeve actuator disposed in said second through aperture and movable between a radially inward position wherein said sleeve actuator is engaged with said coupling end of said plug upon insertion of said plug into said socket and a radially outward position wherein said sleeve actuator is located radially outwardly from said radially inward position; and

said sleeve has an inclined surface inclined radially outwardly from said locking surface toward said unlocking surface, said inclined surface being engaged with said sleeve actuator when said sleeve is located in said locking position, said coupling end of said plug being engaged with said sleeve actuator upon insertion of said plug into the socket so that said sleeve actuator is radially outwardly moved to thereby cause axial movement of said sleeve against the bias of said spring, wherein when said coupling end of said plug is brought into engagement with said locking

element during advancement of said plug, said inclined surface is moved to a radially outward position relative to said locking element, said coupling end of said plug radially outwardly urging said locking element against said inclined surface of said sleeve upon further insertion of said plug, thereby causing further axial movement of said sleeve.

8. A pipe coupling comprising a socket and a mating plug insertable into said socket for coupling engagement,

said socket including:

a cylindrical socket body having a first through aperture extending radially therethrough;

a locking element radially movable within said first through aperture, said locking element being movable between a first radial position wherein said locking element is engaged with a locking recess on said plug so as to inhibit disconnection of said plug from said socket and a second radial position wherein said locking element is radially outwardly displaced from said first radial position and disengaged from said locking recess to allow disconnection of said plug from said socket;

a first sleeve disposed around said socket body and having a locking surface adapted to hold said locking element against radial outward movement and prevent movement of said locking element from said first radial position to said second radial position and an unlocking surface adapted to allow movement of said locking element from said first radial position to said second radial position, said first sleeve being axially movable between a locking position wherein said locking surface is positioned radially outwardly of said locking element and an unlocking position wherein said unlocking surface is positioned radially outwardly of said locking element; and

a spring for biasing said first sleeve toward said locking position,  
said plug including:

a coupling end directed toward said socket; and

a cylindrical surface extending from said coupling end in a direction away from said socket, said locking recess being defined on said cylindrical surface,

said coupling end of said plug being slidably engaged with said locking element located in said first radial position to cause radial outward movement of said locking element when said plug is inserted into said socket,

said socket body comprising:

a second through aperture located axially closer to said plug than said first through aperture and extending radially therethrough and a sleeve actuator disposed in said second through aperture and movable between a radially inward position wherein said sleeve actuator is engaged with said coupling end of said plug upon insertion of said plug into said socket and a radially outward position wherein said sleeve actuator is located radially outwardly from said radially inward position; and

said first sleeve has an inclined surface inclined radially outwardly from said locking surface toward said unlocking surface, said inclined surface being engaged with said sleeve actuator when said first sleeve is located in said locking position, said coupling end of said plug being engaged with said sleeve actuator upon insertion of said plug into the socket so that said sleeve actuator is radially outwardly moved to thereby cause axial movement of said first sleeve against the bias of said spring, wherein when said coupling end of said plug is brought into engagement with said locking element during advancement of said plug, said inclined surface is moved to a radially outward position relative to said locking element, said coupling end of said plug radially outwardly urging said locking element against said inclined surface of said sleeve upon further insertion of said plug, thereby causing further axial movement of said sleeve,

said pipe coupling further comprising:

a second sleeve disposed around said first sleeve and movable between a first axial position and a second axial position, said second sleeve allowing axial movement of said first sleeve upon insertion of said plug when said second sleeve is placed in said first axial position, said second sleeve allowing said first sleeve to be moved from said locking position to said unlocking position against the bias of said



first spring when said second sleeve is moved from said first axial position to said second axial position, said second sleeve being rotatably moved on said socket between a first angular position and a second angular position; and

a stopper arranged on said socket, said stopper being engaged with said second sleeve to prevent axial movement of said second sleeve when said second sleeve is placed in said first angular position,

said second sleeve having a stopper receiving portion configured to prevent engagement of said stopper with said second sleeve and allow axial movement of said second sleeve when said sleeve is placed in said second angular position.

9 A pipe coupling according to claim 8, wherein said spring is a coil spring disposed about said socket body, said coil spring having one end located at a given angular position on said socket body and engaged with said first sleeve to urge said first sleeve toward said locking position, and an other end engaged with said second sleeve to urge said second sleeve toward said first angular position.